

# Risk factors for falls among adults with intellectual disabilities: A narrative review

John Pope<sup>1</sup>  | Maria Truesdale<sup>2</sup>  | Michael Brown<sup>3</sup> 

<sup>1</sup>Edinburgh Napier University, Edinburgh, UK

<sup>2</sup>University of Glasgow, Glasgow, UK

<sup>3</sup>School of Nursing and Midwifery, Queen's University Belfast, Belfast, UK

## Correspondence

John Pope, Edinburgh Napier University, 14 High Row, Washington NE37 2LZ, UK.  
Email: jpope@keyfortgroup.co.uk

## Abstract

**Background:** The prevalence of falls involving people with intellectual disabilities (ID) is high in comparison with the general population. There has been little evidence to date on the contributing risk factors. The objective of this review was to identify risk factors for people with intellectual disabilities.

**Method:** Literature searches were conducted using electronic databases to explore evidence on the subject, and narrative synthesis was employed to analyse the results.

**Results:** Seven risk factors were identified: decreasing physical ability, epilepsy, parietic conditions, impulsiveness, previous falls, incontinence and non-use of assistive equipment. Thematic analysis identified factors across the four concepts: the person, the situation, ongoing and protective factors.

**Conclusion:** Factors for falls involving people with intellectual disabilities are dynamic and multifactorial. Some are specific to the population; however, further research is required to develop the understanding of the possible reasons. The findings have implications across policy, education, practice and research.

## KEYWORDS

factors, falls, intellectual disability, review, risk

## 1 | INTRODUCTION

Falls within health and social care services are the most commonly reported accident (NMS Improvement, 2017). The consequences of significant falls cost services are 70% more during an admission to hospital (Tian, Thompson, Buck, & Sonola, 2013). These falls can contribute to increased contact with United Kingdom healthcare services and result in long-term health implications for individuals, their carers and services.

The Prevention of Falls Network Europe (ProFaNE) define a fall as "an inadvertent occurrence from a person falling to the floor...or some other lower level..." (Lamb, Jorstad-Stein, Hauer, & Becker, 2005). The preferred definition of risk factors comes from the World Health Organisation (2018) who define this as any

attribute, characteristic or exposure the individual has to develop a disease or injury.

The exact incidence levels of falls have not been agreed for people with intellectual disability (ID). Cox, Clemson, Stancliffe, Durvasula, and Sherrington (2010) found incidence levels of falls involving people with intellectual disability at 34% across a 12-month time span and with a mean of 7.21 per person. Finlayson et al. (2014) found 22.5% of their sample (205 participants) falling more than once within a 12-month period. A 12.3% fall rate was found in comparison with 4.3% in the general population within the same study. Smulders, Enkelaar, Weerdesteyn, Geurts, and van Schrojenstein Lantman-de Valk, H. (2013) reviewed older adult intellectual disability services with a 47% fall rate, results comparable to general population falls data within the same paper.

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Sherrard, Tonge, and Ozanne-Smith (2001) proposed falls as a common cause of injury (including fractures) for people with intellectual disability and the suggested high prevalence is an area of concern that requires to be more fully understood. Pal, Hale, Mirfin-Veitch, and Claydon (2014) suggested reduced confidence and restricted mobility as a consequence of a fall can result in secondary health problems such as anxiety. This is an important issue as people with intellectual disability are already widely recognized to experience high levels of lifestyle-related health conditions (McGarry, 2014). Whilst legislation and guidance have been developed based on the needs of the general ageing population (Department of Health, 2009; National Institute of Health and Clinical Excellence (NICE) 2013), there is limited reference to the specific risks related to adults with intellectual disability.

Willgoss, Yohannes, and Mitchell (2010) undertook the first systematic literature review regarding people with intellectual disability and falls risk, with four contributory factors identified: increasing age, epilepsy, mobility and behavioural. The review concluded that research was limited in both quality and quantity to enable a more robust exploration. Recommendations included using different methodologies with large samples and smaller, in-depth qualitative studies. Further, it was suggested that increasing the understanding of risk factors would enable the development of interventions amenable to addressing the factors with the most potential to be modified and minimized (Lord, Ward, Menz, & Close, 2007).

The aim of the current review was to build upon the findings of Willgoss et al. (2010) in exploring the factors that contribute to falls in adults with intellectual disability. The objectives were as follows:

- To identify if the known risk factors associated with falls involving adults with intellectual disabilities remain relevant;
- To identify any new risk factors from 2010 onwards, relevant to adults with intellectual disabilities;
- To critically appraise evidence to identify future implications for research, clinical practice, policy and education

## 2 | METHODS

A 12-step strategy enabled a structured approach to documenting of the search strategy for publication (Kable, Pich, & Maslin-Prothero, 2012). A search was undertaken using the following electronic databases: AMED, CINAHL, MEDLINE and PsycINFO. These databases were chosen due to their focus on healthcare research. In addition, ASSIA, Cochrane Library and Google Scholar were used to supplement the database search. The first search was undertaken in November 2017 followed by a further one in July 2019 to ensure all publications have been included. First, a literature search of electronic databases using the terms detailed in Table 1 was undertaken. Intellectual disabilities (ID) will be the preferred terminology as it is utilized by both the ICD and DSM classifications. However, the

**TABLE 1** Search terminology

S1 AND S2 AND S3

Add search limits

February 2009–October 2017

Full text

English language

"injur\*" OR "fractur\*" OR "fear of falling" OR "accidental fall\*" OR "slip\*" OR "trip\*" OR "fall\*" OR "stumble" OR "loss of balance" OR "unintentional injury" OR "trauma"

risk factor\*" OR "rate of" OR "risk\*" OR "epidemiology"

intellectual disabili\*" OR "learning disabilit\*" OR "developmental delay" OR "cognitive impairment\*" OR "mental handicap" OR "mental retardation" OR "developmental disabilit\*"

search also covered other terms including learning disabilities, mental retardation and developmental disorder.

Articles were then reviewed by the first author against agreed inclusion and exclusion criteria and agreed and confirmed by the research team to ensure rigour. Papers were first reviewed against their title and full available abstract on the database entry.

### 2.1 | Inclusion criteria

- Population with an age over 18 years with no upper age restrictions
- Adults with intellectual disability—all diagnostic categories to be considered
- Studies with report data outcomes on risk factors for falls and terms associated with falls (e.g. stumbles, trips)
- Published in English and academic journals
- Any geographical location or any accommodation type
- Participants who live independently or have support (e.g., family members, paid carers)
- Description of research methodology is included
- Published from February 2009 to July 2019

### 2.2 | Exclusion criteria

- Population sample under 18 years of age
- Falls data relates to exploration other impairments (e.g. dementia, brain injury, degenerative condition)
- Studies which do not report any falls risk factors in their results
- Not published in academic journals
- Single case-study designed, opinion pieces, commentaries, editorials, conference texts or are unable to describe a methodology
- Published before February 2009.

### 2.3 | Quality appraisal

Quality appraisal of the papers that met the criteria was undertaken by the research team using the Critical Appraisal Skills Programme

(CASP) (Critical Appraisal Skills Programme, 2013). Each paper was scored as follows zero—not met as no details were provided, 1—partially met if some details were provided and 2—fully met if details were provided Voss and Rehfuess (2013). A score of 17 or above demonstrates strong qualities with scores under 10 being considered weak. Papers scoring between this will indicate good qualities with some limitations.

## 2.4 | Identification of themes

Papers were analysed using narrative synthesis (Popay et al., 2006). Following initial review, the remaining papers were reviewed thematically and commonly recurring rubrics were identified. This was due to the papers included having both qualitative and quantitative data, a narrative synthesis approach enabled themes to be drawn out.

In developing a common rubric, if the  $p$  value  $> .05$ , results data were extracted. A preliminary examination identified few factors demonstrating  $p > .01$ . Odd ratios of  $> 1$  indicating risk factors and  $< 1$  suggesting a protective factor. Risk factors which appeared in more than one paper and meeting the  $p$  value are set out in Table 2.

Thematic analysis process started with each paper being re-read, with extracts identified based on the relevancy to the review questions. An inductive method was used to develop coding of key themes. Themes were re-visited throughout a two-week period, re-reading the extracts to provide opportunity to ensure themes were consistent. All themes were confirmed by the research team (Appendix 1).

**TABLE 2** Odds ratio for quantitative papers

	Odds ratio/%	
Engaged in vital activity (e.g. personal care)	2.05	Axmon et al. (2018)
Place of fall—Institution	13.8	Axmon et al. (2018)
Decreasing physical ability	2.12	Hsieh et al. (2012)
Epilepsy	4.64	Chiba et al. (2009)
	5.16	Cox et al. (2010)
	2.527	Finlayson et al. (2010)
Paretic Conditions (e.g. Cerebral Palsy)	30.98	Chiba et al. (2009)
	4.12	Cox et al. (2010)
Unpredictability/Impulsiveness <sup>a</sup>	102.59	Enkelaar et al. (2013)
Previous falls history	2.91	Cox et al. (2010)
Incontinence (urinary)	1.976	Finlayson et al. (2010)
	2.25	Hsieh et al. (2012)
Non-prescriptive use of assistive equipment	3.00	Hsieh et al. (2012)
	6.44	Axmon et al. (2018)

<sup>a</sup>Included due to significantly high odds ration in comparison to rest of the data.

## 3 | RESULTS

### 3.1 | Literature search results

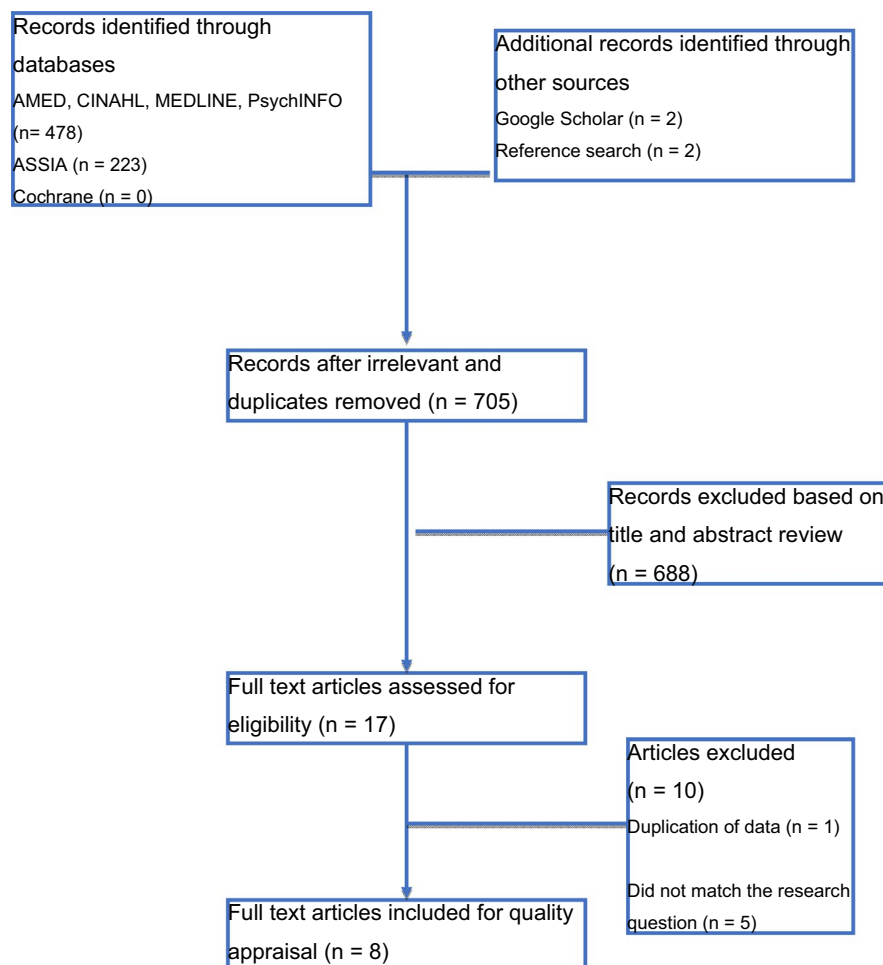
Figure 1 provides a flow chart of the literature search. The initial search identified 706 records after duplicates were removed. Seventeen full-text records remained following screening by title and abstracts using the inclusion criteria. Following a review of full texts, ten papers were excluded as they did not meet the study criteria, leaving seven papers for full quality appraisal. Reasons for papers being excluded were as follows: duplication of data ( $n = 1$ ), not meeting the review questions ( $n = 5$ ) and not meeting the inclusion criteria ( $n = 4$ ). One further paper was identified and included during July 2019 search.

### 3.2 | Study characteristics

Eight papers met the inclusion criteria. Paper publication dates ranged from 2009 to 2019. One paper (Chiba et al., 2009) was published prior to the previous review by Willgoss et al. (2010) and not included in their review. Papers were wide-ranging in geographical spread; two papers in Australia (Cahill, Stancliffe, Clemson, & Durvasula, 2014; Cox et al., 2010) and one in Japan (Chiba et al., 2009), Netherlands (Enkelaar, Smulders, van Schrojenstein, Weerdesteyn, & Geurts, 2013), Sweden (Axmon, Ahlstrom, & Sandberg, 2018), Scotland (Finlayson, Morrison, Jackson, Mantry, & Cooper, 2010), United States (Hsieh, Rimmer, & Heller, 2012) and New Zealand (Pal et al., 2014). Sample sizes ranged from 9 to 1515 with a percentage of male participants ranging from 44% to 55.1%. Overall, 2,506 participants were reached by the included papers. This excludes Axmon et al. (2018) who reviewed falls incidents rather than falls in the intellectual disability population. Three papers did not provide data on the level of intellectual disability (Axmon et al., 2018; Hsieh et al., 2012; Pal et al., 2014). The studies by Cox et al., (2010), Cahill et al., (2014) and Enkelaar et al. (2013) involved participants with mild to moderate intellectual disability, with none experiencing profound intellectual disability. The sample in the Chiba et al., (2009) study had 81.9% of participants with a severe to profound intellectual disability. Finlayson et al., (2010) included a range from mild to profound intellectual disability.

Accommodation varied across the studies from supported living to residential facilities; no study was conducted in a hospital setting. Three papers included qualitative methodologies using focus groups (Pal et al., 2014), semi-structured interviews (Cahill et al., 2014; Finlayson et al., 2010) and reconstruction events (Cahill et al., 2014). Papers used quantitative collection methods including standardized assessment (Chiba et al., 2009; Enkelaar et al., 2013), questionnaires on health data (Axmon et al., 2018; Cox et al., 2010; Finlayson et al., 2010; Hsieh et al., 2012) and retrospective carer reporting on standardized documentation (Cox et al., 2010; Enkelaar et al., 2013; Pal et al., 2014).

**FIGURE 1** Literature search flow chart [Colour figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]



### 3.3 | Quality appraisal

CASP scores for papers ranged from 13 to 18. Cox et al., (2010) and Finlayson et al., (2014) completed retrospective questionnaires from caregivers over a one-year timeframe. Pal et al., (2014) used immediate reporting after a fall, with Enkelaar et al., (2013) introducing a falls calendar with specific markers to be completed within a 24-hr period and Cahill et al., (2014) using falls reconstruction. Axmon et al. (2018) reviewed falls incidents across a longitudinal time frame. The measurement method adopted is important, as retrospective designs must clearly detail how recall bias was accounted for and minimized to ensure reliability. However, no study evidenced how researcher bias impacted on the data collection and was minimized. No study detailed how people with intellectual disability were involved in the data collection or how target sample was determined. Details regarding the ethics process and approval was limited in all but the Pal et al., 2014 study.

Four themes were identified: the person, the situation, ongoing factors and risk protectors.

### 3.4 | Risk factors for the individual

Three papers identified increasing age as a risk factor (Chiba et al., 2009; Cox et al., 2010; Enkelaar et al., 2013). Axmon et al.

(2018) identified risk of falls increased from 3.5% to 6.6% for people with intellectual disability over 55 in a ten-year period in comparison with 1.7% to 3.2% in the general population. Chiba et al., (2009) and Cox et al., (2010) noted that intellectual disability alone was not an identifiable risk factor. Cahill et al., (2014) proposed the limitations of cognitive insight as the risk factor rather than intellectual disability per se. Enkelaar et al., (2013) identified that people with mild intellectual disability were more exposed to situations that they may not have insight to predict and resolve, thereby placing themselves at risk of falls.

Three studies identified that females with intellectual disability fell more than males (Enkelaar et al., 2013; Hsieh et al., 2012; Pal et al., 2014). One study identified gender as not being statistically significant (Cox et al., 2010), with the possible reasons for gender differences not identified in any of the papers. Four papers reported pre-existing conditions related to muscle weakness as a risk factor, such as cerebral palsy (Cahill et al., 2014; Chiba et al., 2009; Cox et al., 2010; Hsieh et al., 2012). The study by Cahill et al. (2014) explored reasons why, indicating that these co-morbidities predisposed the person to atypical gait patterns making them prone to losing their balance. Two papers describe strength limitations as a risk factor, resulting from underlying conditions such as arthritis or osteoporosis (Cahill et al., 2014; Hsieh et al., 2012). Some were more likely to falling again if they had a

falls history (Cahill et al., 2014; Cox et al., 2010 and Pal et al., 2014). Epilepsy was identified as a significant risk factor in three studies (Chiba et al., 2009; Cox et al., 2010; Finlayson et al., 2010). Cahill et al. (2014) found that people who fall during seizures are incapable of initiating protective mechanisms.

### 3.5 | The situation

Falls can occur spontaneously and immediately. Two studies identified a number of risk factors at the moment of a fall; increased mobility, impulsivity and location. Cox et al., (2010) and Enkelaar et al., (2013) found no significant difference in the balance and gait between people with intellectual disability who fell and those who did not. Enkelaar et al., (2013) found impulsivity and distractibility to be important as a contributory factor related to falls. An ability to initiate protective mechanisms, such as "cushioning" the fall, was identified by Cahill et al., (2014).

Falls were more likely to occur indoors and during the daytime (Pal et al., 2014). Enkelaar et al., (2013) found that people with intellectual disability who fell indoors performed significantly worse in balance and gait assessments. People with intellectual disability were more likely to take risks in their home environment as it was perceived to be "less risky" than outdoors when encountering hazards, such as people, furniture and temporary environmental changes (Cahill et al., 2014). Axmon et al. (2018) found a significant risk of falls within institutionalized environments in comparison to other types of accommodation. Carers were more likely to be safety vigilant when outdoors in comparison with indoors when vigilance was more relaxed (Pal et al., 2014). Finlayson et al., (2010) describe that falls outdoors were more likely to occur in the autumn or winter.

### 3.6 | Factors for ongoing risks

Chiba et al., (2009) identified that anticonvulsant medication increased falls in people with intellectual disability. The reason for this factor was not explored further within the study. Enkelaar et al., (2013) found no difference between fallers and non-fallers taking anticonvulsant medication. Two papers highlighted urinary incontinence as a significant factor contributing to falls in people with intellectual disability (Finlayson et al., 2010; Hsieh et al., 2012) with two further studies indicating the bathroom as the main place for falls due to rushing to the toilet (Cahill et al., 2014; Cox et al., 2010). Axmon et al. (2018) identified that people with intellectual disability were more likely to fall when engaged in activities such as personal care, toileting, eating or sleeping.

The role of carers in falls management was identified. Cahill et al., (2014) found difficulties with the consistency of support in combination with impulsive mobility led to increased risk in some participants with intellectual disability. When not verbally prompted regarding hazards alongside their lack of insight, there was an increase in falls. Finlayson et al., (2010) found that carers felt many falls experienced by some people with intellectual disability were

not preventable and were often described as "clumsy". Carers stated falls occurred mainly due to slips, trips and loss of balance (Cox et al., 2010). Carers were more likely to record "unspecified activity" (i.e. the person was doing an activity which could not be categorized) in their documentation than the general population (Axmon et al., 2018). This means the assessment of falls was made difficult as the information recorded was not specific.

The inappropriate or non-use of assistive equipment was identified in four studies as an important contributory factor related to falls in some people with intellectual disability (Cahill et al., 2014; Finlayson et al., 2010; Hsieh et al., 2012; Pal et al., 2014). Pal et al., (2014) noted that while some participants had orthopaedic conditions, few used walking equipment. Cox et al., (2010) and Pal et al., (2014) found that participants always listed more than one cause of a fall occurring, suggesting an awareness that falls are multifactorial. Enkelaar et al., (2013) described the interplay between personal and environmental factors, with Cahill et al., (2014) adding the contextual factors to the dynamic. Both concluded that risk factors should not be viewed in isolation.

### 3.7 | Protective factors that reduce falls

Finlayson et al., (2010) noted that participants with Down's Syndrome fell less when compared to other people with intellectual disability; however, reasons were not explored. Autism spectrum disorder (ASD) was also identified as a protective factor regarding falls. People with ASD were less inclined to interact with the environment and in some cases, increased hypersensitivity to their surroundings created risk adversity. Cahill et al., (2014) highlighted the importance of carer vigilance and the awareness of environmental modifications in preventing falls. Traditional falls risks such as rugs, dim lighting and trip hazards were removed by carers. Enkelaar et al., (2013) noted that people with moderate to severe intellectual disability with poor motor control were more likely to be protected from falls by carers.

## 4 | DISCUSSION

This narrative review of the research evidence has identified risk factors which influence falls for people with intellectual disability. The findings from the analysis of the studies have implications across clinical practice, policy, education and research. The aim of this paper was to review the risk factors for people with intellectual disability. The papers reviewed have answered the research question in identifying risk factors further to the initial literature review conducted by Willgoss et al. (2010).

### 4.1 | Implications for clinical practice

There are a limited number of studies analysing the efficacy of falls interventions specific to people with intellectual disability.

The limited evidence may be due to the knowledge of the risk factors from which interventions can be developed. Health professionals were found to rely on trial and error to guide their clinical reasoning (Pal et al., 2014). Therefore, the findings from this paper will increase the awareness of the falls risk factors and inform practitioner clinical decision making, thereby aiming to reduce the falls incidence.

There are differences in the falls factors for people with intellectual disability in comparison with the general population. Cahill et al., (2014) supported Willgoss et al., (2010)'s initial finding that people who are more mobile are at risk of falls. This may be due to poorer appraisal of the situation or slower reaction times immediately prior or during a fall when rapid remedial adjustments are needed. Impulsivity and a varying ability to dynamically appraise risk are both factors which are specific to intellectual disabilities. Furthermore, females with intellectual disability fell more than males with intellectual disability. This finding is different to the general population, in which males are more likely to fall than women (Pereira, Baptista, & Infante, 2013).

Epilepsy was identified as a significant risk, with the effective management of epilepsy being critical in reducing the risks of falls and associate injuries (Haldar, 2017). It is estimated 22% of people with intellectual disabilities experience epilepsy, a significantly high level in comparison with other populations, at 1% (Robertson, Hatton, Emerson, & Baines, 2015). Pal et al., (2014) recommended research reviewing seizure versus non-seizure falls in people with intellectual disability and epilepsy.

There is a reoccurring theme across the studies in this review of the dynamic and multifactorial nature of falls for people with intellectual disability. These findings suggest that falls do not occur due to isolated single factors such as strength loss, environment or medication, a finding supported by the Willgoss et al., 2010 review. Therefore, in an attempt to reduce falls, practitioners need to reconsider whether single factor interventions are effective in addressing the dynamic nature of falls. A pursuit of individual factors may be why existing research lacks the evidence necessary to reduce falls (Chase, Mann, Wasek, & Arbesman, 2012; National Institute of Health and Clinical Excellence (NICE) 2013). Smulders et al., (2013) identified a lack of risk screening tools specific to the needs of people with intellectual disability. This means multi-factor interventions are unable to target relevant risk factors. Lord et al., (2007) recommended risk factors with the most potential for modification should be targeted. Risk factors with no scope for external modification are age, gender, previous falls and co-morbidities. Therefore, the risk factors identified in this review could provide the basis for the development of a screening tool sensitive to the specific needs of people with intellectual disability.

The increasing number of risk factors that have emerged since the Willgoss et al., 2010 review suggests that there are a number of areas for intervention. These include prescription and education on assistive aids, strength programmes, environmental adaptations, including a review of toilet access, a review of personal activity safety and patient, family and carer education. Smulders et al., (2013) noted

the introduction of a falls clinic specifically for people with intellectual disability had a 23% decrease in falls rate; this is an area requiring further study. It is important to note the similarities in risk factors within other demographics (Hendricks et al., 2005); however, caution is expressed as some factors identified are specific for people with intellectual disability.

Practitioners must also be aware of the importance of family and carer roles as at present, their knowledge of the reasons for falls appears limited to the moment of the actual fall (Cahill et al., 2014). Factors were referred to as "slips and trips" (Cox et al., 2010) and were not felt to not be preventable (Finlayson et al., 2010). Practitioners need to therefore identify how they can improve family and carer awareness as a means to improve falls prevention. Families and carers are often the main source of information, particularly if the person with intellectual disability is unable to communicate their needs and are ever-present after the practitioner-led interventions have concluded. Therefore, practitioners need to identify how their strategies can reduce risk factors after their input has ended, with a focus on upskilling families and carers. This can include education on assistive equipment, understanding safety in transient environments and risk awareness education. There is also a role in ensuring carers are able to proactively highlight when people are more at risk of falls. Developing tools which enable families and carers to highlight those at significant risk of falls could be beneficial. This approach would provide timely response to any potential falls and therefore reduce the reactive response (Pal et al., 2014).

## 4.2 | Implications for policy

Policymakers have concentrated on the needs of older persons for recommendations around falls. Finlayson (2018) described the falls rate between people with intellectual disability and wider older adult populations to be similar; therefore, there is a need to ensure policy is meeting needs. The Department of Health (2009) placed focus on early intervention, restoring independence and fracture management. However, it can be argued that risk factors for people with intellectual disabilities contrast these recommendations. There are already predisposing factors, some of which may require the support of others to maintain independence (paretic conditions, epilepsy, cognitive insight). Whilst policy suggests the general population who are frail and live poor health lifestyles are more prone to falls (Department of Health, 2009), this paper asserts the opposite can be true for people with intellectual disabilities. Those who are more mobile and able to live with increasing independence were more at risk (Cahill et al., 2014 and Enkelaar et al., 2013). Policymakers need to be aware of these findings to ensure the needs of people with intellectual disabilities is reflected.

## 4.3 | Implications for education

This research has the potential to add to the education of health professionals by demonstrating how the risk factors differ for people with



intellectual disability when compared to other populations. The findings from this study have implications in developing understanding on the risk factors for falls in people with intellectual disability. Training programmes, based on the risk factors thereby increasing awareness and developing practice, could be developed. It provides insight into the challenges in addressing the issue given the wider number of factors specific to people with intellectual disability which have been identified. It is important any education programmes, aimed at families and carers are set in the context of their important role in preventing falls.

#### 4.4 | Implications for future research

Eight papers in the current study were of good quality following critical appraisal, indicating the need to improve the quantity of the evidence. There are three Cochrane systematic reviews of falls: two for older people (Gillespie et al., 2012 and Cameron et al., 2018) and one for people following stroke (Verheyden et al., 2013). Future study needs to be conducted that research the range of risk factors across by utilizing and integrating a range of research methodologies. There is also a need to ensure falls are researched in context of the environmental influences, a recommendation that was made in the review by Willgoss et al., (2010).

It is important to ensure people with intellectual disability have their experiences of falls included in future research; two qualitative studies in the current focused on their views and experiences (Cahill et al., 2014 and Pal et al., 2014). A challenge appeared to be the ability to recruit and engage people with intellectual disability as participants. No study within this review was able to independently recruit participants with intellectual disability. Whilst there could be a research focus on people with mild intellectual disability who are increasingly independent and fall more, caution is expressed in discrimination against those who may have difficulties independently consenting to participate and yet have valuable contributions and experiences of falls (Goldsmith & Skirton, 2015). Therefore, future research needs to consider how all people with intellectual disability can be engaged within falls research, by addressing sampling and recruitment methods and navigating the complexities of research ethics.

This study identified a number of areas with specific risk factors for people with intellectual disability. Age has been suggested as an important risk factor; however, only two studies have assessed the older intellectual disability population (Axmon et al., 2018 and Enkelaar et al., 2013). Three studies identified female gender as a risk factor; however, further research is required to identify possible explanations if this is the case. Four studies suggested paretic conditions, highlighting the influence of muscle weakness on the risk of falls. Future research needs to look at scenarios where a person may need to rush or act in impulsively as a factor that resulting in a fall. Pal et al., (2014) recommended further epilepsy research, particularly falls which do not appear to occur due to seizures. This study has identified co-morbidities which could be protective factors against falls, including Autism and Down Syndrome. This is a new finding and an area requiring further study to investigate possible protective factors, thereby generating new strategies to reduce risk of falls.

#### 4.5 | Review limitations

This study aimed to build on the initial systematic review by Willgoss et al., (2010). The authors acknowledge that it is possible that not all studies were identified through the database searches or grey literature. The included studies were published in English and therefore those published in other languages were not included. No studies were located from Africa or South America therefore the generalization of the studies across geographical locations is a limitation.

Due to the limited return of studies that met the inclusion criteria, there was limited scope to compare and contrast similar research approaches. This influenced the quality appraisal tool utilized and the method of synthesis chosen. The use of a narrative synthesis approach was adopted to minimize the risks of bias by presenting the analysis of the evidence using recognized strategies.

### 5 | CONCLUSION

The number of risk factors identified has increased since Willgoss et al., (2010)'s review. This review evidences the dynamic and holistic nature of falls as experienced by people with intellectual disability. Further research is required to more fully understand the factors that present distinct risks for people with intellectual disability and strategies to overcome them as they differ from the general population. People with intellectual disability who fall are often not included in research from which they may benefit. The findings from the current review support the need for practitioners to change and modify factors that can result in falls and recognizing the key indicators of the risk of falls. The evidence derived from the review provides further knowledge into the risk factors for falls and falls prevention in people with intellectual disability.

#### CONFLICT OF INTEREST

There are no known conflicts of interest from the authors in the submission of this manuscript.

#### ORCID

John Pope  <https://orcid.org/0000-0001-6214-0234>

Maria Truesdale  <https://orcid.org/0000-0003-3081-7858>

Michael Brown  <https://orcid.org/0000-0003-3230-401X>

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# APPENDIX 1

## SUMMARY OF INCLUDED ARTICLES FOR QUALITY APPRAISAL

Author (Year) Country	Sample size and context	Severity of intellectual Disability	Age range	Gender (male %)	Study design	CASP Score	Summary of risk factor themes	Additional Comments
Axmon et al. (2018)	7,996 falls were reviewed for people with intellectual disability versus 3,657 falls for general population.	Not reported	Over 55	54.5%	Quantitative reviewing intellectual disability v general older population. Comparison of data stored on Swedish National Patient Register	15	Older people with intellectual disability higher risk of falls. More likely when at home or during a vital activity of personal care ( $p = 2.05$ ) Increased risk of falls in institutional settings ( $p = 13.8$ ) More likely to have 'unspecified activity' recorded as reason for a fall.	Falls risk increased from 3.5% to 6.6% over a ten-year period for an older person with intellectual disability, in comparison with 1.7% to 3.2% for general population.
Cahill et al. (2014) Australia	9 people with intellectual disability and their carers family living and 4 in group home Inclusion criteria only fallers in last 6 months	$n = 9$ <b>Mild:</b> 3 <b>Mod:</b> 3 <b>Sev:</b> 3 <b>Pro:</b> 0	21–65	44%	Qualitative home visits and ethnographic interviews. Falls reconstruction undertaken. Thematic analysis	15	Themes identified across 3 domains; <b>Individual</b> (decreased physical capacity, disability, cognition, personality, epilepsy) <b>Behavioural</b> (distraction, rushing, unpredictable movements, previous falls, limited equilibrium) <b>Contextual</b> (startles, familiarity of environment, support, impact of others, reduced environment)	In all cases, it was an interaction of factors which led to a fall. They cannot be defined to one specific risk factor and must be viewed as multifactorial in nature. Epilepsy-related falls are limited in being prevention and more management focused (e.g. medication, environment). Study suggests that internal risk factors are difficult to modify through intervention so focus should be on environmental. Described falls reconstruction as a technique in analysing falls in research and practice.

Author (Year) Country	Sample size and context	Severity of intellectual Disability	Age range	Gender (male %)	Study design	CASP Score	Summary of risk factor themes	Additional Comments
Chiba et al. (2009) Japan	144 residents Living in residential care facility	$n = 144$ <b>Mild:</b> 3 <b>Mod:</b> 18 <b>Sev:</b> 50 <b>Pro:</b> 68	28–68	49%	Quantitative Fallers ( $n = 41$ ) Vs Non-falls ( $n = 103$ ) control groups Focus on balance and gait measures in persons over 50 with years follow-up.	16	Epilepsy (x 6.55 risk) ( $p = 4.64$ ) Paresis (x 30.98 risk) Increasing age (1.8 times over 10 years increase)	Level of intellectual disability was not an independent risk factor. Recognizes a need to increase research for risk of falls in older persons with intellectual disability inetti balance score used as clinical measure. Score was significantly worse within the faller group.
Cox et al. (2010) Australia	114 patients attending general medical clinic for people with intellectual disability. Focus on people outside of formal care arrangements	$n = 114$ <b>Mild:</b> 41 <b>Mod:</b> 46 <b>Sev:</b> 24 <b>Pro:</b> 0 <b>Unknown:</b> 6	18–63	55.3%	Quantitative Retrospective feedback questionnaire using medical information and a 12 months falls history to identify themes in data	13	Increasing age Having a seizure in the past 5 years ( $p = 5.16$ ) Having a fracture history ( $p = 2.91$ ) erebral palsy was identified as significant factor in patients without epilepsy however requires further research into the diagnosis' influence on gait abnormality. ( $p = 4.12$ ) Most common proxy reported factor—slips or trips	84% of participants fell within the preceding 12 months. Location of falls is influenced by freedom of movement of the patients. High number of falls occurred indoors which may reflect lifestyles of this population. Most common location: Bathroom following by the bedroom.

Author (Year) Country	Sample size and context	Severity of intellectual Disability	Age range	Gender (male %)	Study design	CASP Score	Summary of risk factor themes	Additional Comments
Enkelaar et al. (2013) Netherlands	73 in full study (Inc. 1-year follow-up) from 3 service providers in the Netherlands.	$n = 78$ <b>Mild:</b> 34 <b>Mod:</b> 42 <b>Sev:</b> 0 <b>Pro:</b> 0 <b>Unknown:</b> 2	51–84	56%	Quantitative Home interviews with baseline assessments (cognitive, caregiver questionnaires, mobility tests) with a 1-year follow-up Falls monitored using falls calendar and incident forms.	18	Falls risks increased; a lower intellectual disability severity, increased physicality, those with better attention and visuo- motor skills. Impulsive behaviour ( $p = 102.59$ ) No difference found in balance and gait between fallers and non-fallers with intellectual disability.	Outdoor fallers were younger, had better motor capacity and more physically active than indoor fallers. Epilepsy falls were excluded from this review as the cause was identifiable. Hypothesis given is caregivers are less protective as the person is more independent, exposing them to more hazardous situations however this has not been tested.
Finlayson et al. (2010) Scotland	511 participants across Greater Glasgow. No limitation on living context or support received	$n = 511$ <b>Mild:</b> 201 <b>Mod:</b> 117 <b>Sev:</b> 97 <b>Pro:</b> 96	16–79	53.4%	Mixed methods (T1) Questionnaires designed to analyse demographics and medical conditions. (T2) Semi- structured questionnaire on injuries plus questionnaires for carers including a 5-point Likert scale	13	Epilepsy a risk factor. ( $p = 2.527$ ) Non-epilepsy- related risk factors; Urinary incontinence. ( $p = 1.976$ ) Clumsiness Season of the year (in particular winter) Down's syndrome reduced the risk of falls though hypothesis are not tested as to why.	Falls are experienced across adults of all ages. Factors such as male gender, increasing age, co-morbidity, mental health, medication, confidence levels, activity, ill-fitting shoes and area deprivation were not relevant for this population.

Author (Year) Country	Sample size and context	Severity of intellectual Disability	Age range	Gender (male %)	Study design	CASP Score	Summary of risk factor themes	Additional Comments
Hsieh et al. (2012) United States	1515 sample across 50 states in various residential settings.	$n = 1515$ Severity of intellectual disability not reported	18–86	55.1%	Quantitative Retrospective survey (Mail and online) which asked for health data Outcome measures utilized: Falls occurrence Demographic Medical Psychosocial Physical activity	15	Female Increasing age Chronic health conditions including arthritis, heart condition, osteoporosis Epilepsy Polypharmacy Non-prescriptive use of assistive equipment ( $p = 3.00$ ) Physical limitations (unable to carry a 10lb load and/or walk 3 blocks) ( $p = 2.12$ ) Urinary incontinence ( $p = 2.25$ ) Back pain	Results were split into three categories: epilepsy, non- epilepsy and falls requiring medical care.
Pal et al. (2014) New Zealand	135 participants Three service providers in 2 South Island cities	Not reported The study used the New Zealand definition of intellectual disability which does not provide categorisations.	22–71 (across the 3 groups)	51.9% (across the 3 groups)	Qualitative 3 processes: stakeholder consultation, focus groups and prospective study.	17	Orthopaedic- related conditions Gait and balance problems Behavioural issues Female Types of footwear More likely to occur indoors (78%) than outdoors	Asks whether a diagnosis of epilepsy is a risk factor in itself and whether people with epilepsy have non- seizure-related falls. Concern raised by carers around increased permanent support at a younger age as a result of falls injury.